

Food production: crop plants

Revision notes · How glasshouses, fertilisers, pesticides and biological control are used to increase the yield of crop plants.

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

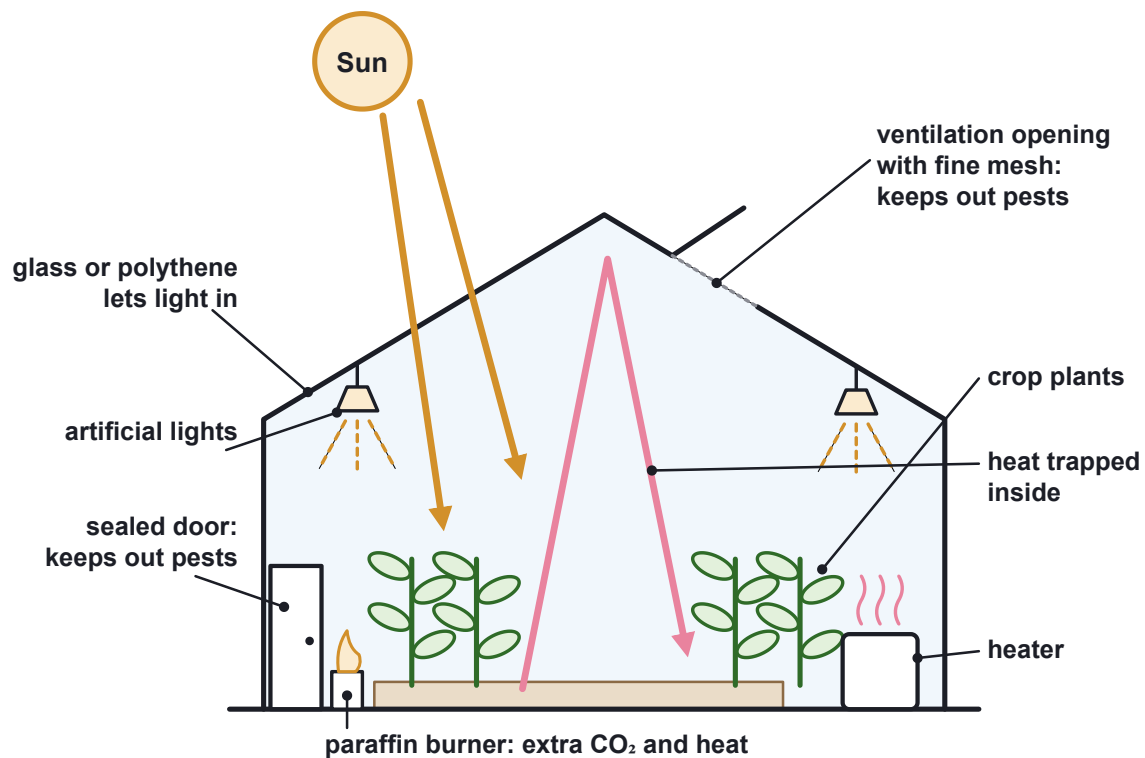
Food production: crop plants Spec 5.1-5.4

Glasshouses and polythene tunnels Spec 5.1, 5.2

Farmers can increase the **yield** of some crops, such as tomatoes and cucumbers, by growing them in **glasshouses** or polythene tunnels. These structures let the farmer control the conditions around the plants instead of relying on the weather.

How glasshouses and polythene tunnels help

- They trap heat from the Sun, so the air is warmer than outside. Heaters can be added to keep the temperature at the optimum for the enzymes in photosynthesis.
- Clear glass or polythene lets light in. Artificial lighting can be used to extend the day length so plants photosynthesise for longer.
- Carbon dioxide can be added to the air, for example by burning paraffin, which also releases heat.
- They protect crops from strong wind, heavy rain, frost and many pests, so less of the crop is damaged or lost.
- The growing season can be longer, so crops can be grown at times of year when they would not grow outside.



A glasshouse lets the farmer control **light, temperature and carbon dioxide**, and keeps out pests.

Effect of carbon dioxide and temperature on yield

Photosynthesis makes the glucose that plants use to grow. Its rate can be limited by light intensity, carbon dioxide concentration or temperature, whichever is in shortest supply.

- **Increased carbon dioxide:** if carbon dioxide is the limiting factor, adding more increases the rate of photosynthesis. The plants make more glucose, grow faster and the yield rises.
- **Increased temperature:** a warmer glasshouse increases the rate of photosynthesis, because the enzymes work faster, up to the optimum temperature. Above the optimum the enzymes are denatured and the rate falls.

Costs and benefits of controlling conditions		
Condition controlled	Benefit to the plant	Cost or limit
Higher CO₂	Faster photosynthesis if CO ₂ was limiting, so a higher yield	Cost of the fuel or gas; no extra benefit if another factor is limiting
Higher temperature	Faster photosynthesis and growth, up to the optimum	Heating costs; too hot denatures enzymes
Extra light	More photosynthesis, especially in winter	Cost of electricity

*Exam tip: Say that the factor must be **limiting** for adding more to help. Then link the faster photosynthesis to more glucose and so more growth and a higher yield.*

Fertilisers, pesticides and biological control Spec 5.3, 5.4

Fertilisers

Crops take mineral ions, such as nitrates, from the soil. When a crop is harvested, these ions are removed from the field. **Fertilisers** replace them. They contain mineral ions such as nitrate (for making proteins), phosphate and potassium.

With more mineral ions available, the plants grow faster and bigger, so the **crop yield** is higher. Without enough of them, growth is poor and the leaves may turn yellow.

Common mistake: Fertilisers are not plant food. Plants make their own food by photosynthesis. Fertilisers supply the mineral ions plants need to make proteins and other substances.

Why pests are controlled

A **pest** is an organism that damages a crop, such as an insect that eats the leaves. Pests reduce the yield, because they eat the plants or spread disease, and they lower the quality of the crop. Farmers control them to protect the yield.

Pesticides

Pesticides are chemicals that kill pests, for example insecticides that kill insects.

Pesticides	
Advantages	Disadvantages
Kill pests quickly and effectively, so the yield is protected	Can kill harmless or useful organisms, such as bees, that are not the pest
Easy to apply over a large area	Can build up in food chains, so top consumers get a high dose
Cheap compared with the value of the crop saved	Pests can evolve resistance, so the pesticide stops working
Can be used as soon as the pest appears	Can wash into rivers and harm wildlife; may leave residues on food

Biological control

Biological control uses a living organism to reduce the pest population. For example, ladybirds are released to eat aphids, or a parasite is introduced that lays its eggs in the pest.

Biological control	
Advantages	Disadvantages
No chemicals, so no harmful residues on food or in the environment	Slower than pesticides and rarely removes the pest completely
Usually targets only the pest, so other organisms are not harmed	The control organism may become a pest itself, or may feed on other species
Pests do not become resistant in the same way as they do to chemicals	The control organism may not survive or may leave the area, so it needs to be managed

Exam tip: An evaluation needs both sides. Give at least one advantage and one disadvantage, each explained, not just named.

Quick check

1. Name two ways a glasshouse can increase the yield of a crop.
2. Why does adding carbon dioxide increase yield?
3. What do fertilisers supply to crop plants?
4. Give one disadvantage of using pesticides.
5. What is biological control?

Quick check answers

Food production: crop plants

1. Any two from: higher temperature, added carbon dioxide, extra light, protection from pests and weather.
2. If carbon dioxide is limiting, photosynthesis is faster, so more glucose is made for growth.
3. Mineral ions, such as nitrates, phosphates and potassium.
4. Any one from: kill non-target organisms, build up in food chains, pests become resistant, pollute water.
5. Using a living organism to reduce the population of a pest.